

CHAPTER 1

INTRODUCTION

Representation in Science and Engineering

The Science and Engineering Equal Opportunities Act of 1980 declares that

it is the policy of the United States to encourage men and women, equally, of all ethnic, racial, and economic backgrounds to acquire skills in science, engineering and mathematics, to have equal opportunity in education, training, and employment in scientific and engineering fields, and thereby to promote scientific and engineering literacy and the full use of the human resources of the Nation in science and engineering.¹

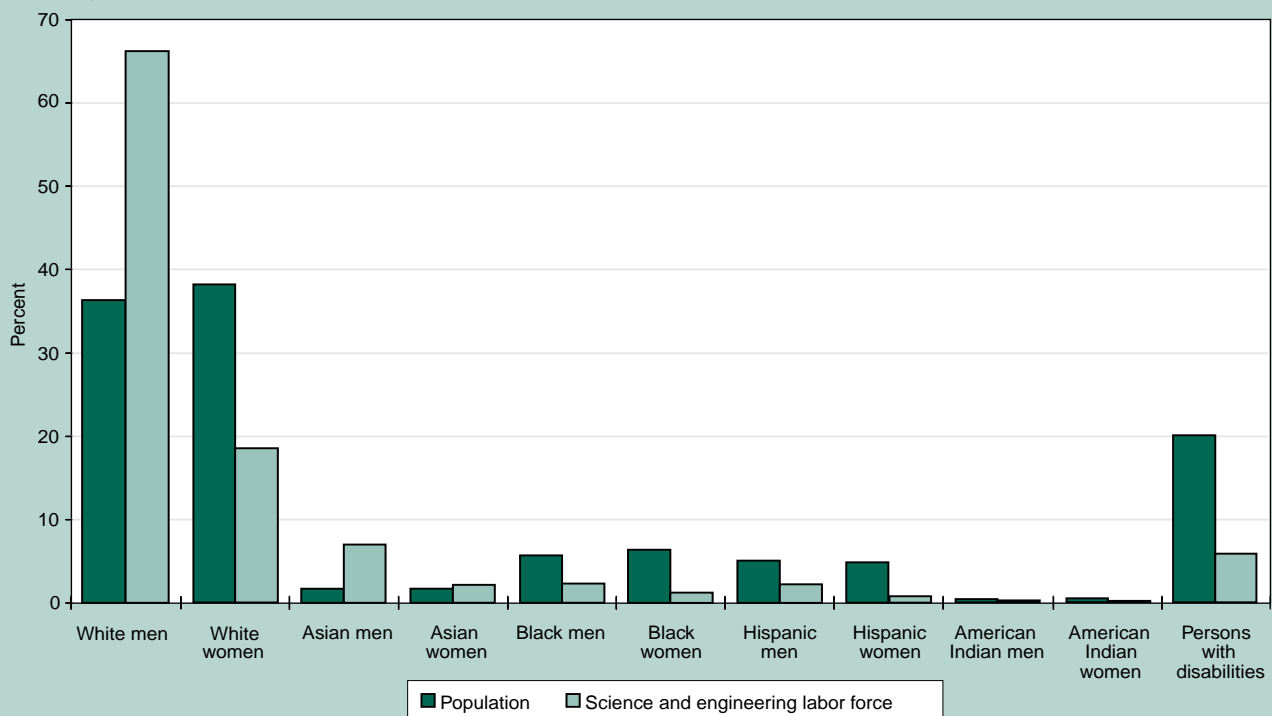
Women, minorities, and persons with disabilities² are underrepresented in scientific and engineering occupations. (See figure 1-1.) Some progress has been made over the last several decades, especially in the number of degrees awarded to women, but there is still room for improvement. Women and underrepresented minorities—blacks, Hispanics, and American Indians—take fewer high-level mathematics and science courses in high school; earn fewer bachelor's, master's, and doctoral degrees in science and engineering; and are less likely to be employed in science and engineering than are white males.

¹ Science and Engineering Equal Opportunities Act, Section 32(b), Part B of P.L. 96-516, 94 Stat. 3010, as amended by P.L. 99-159.

² See appendix table 1-1 for federal definitions of disability categories.

Figure 1-1.

Percentage of the U.S. population and the science and engineering labor force, by sex, race/ethnicity, and disability status: 1993

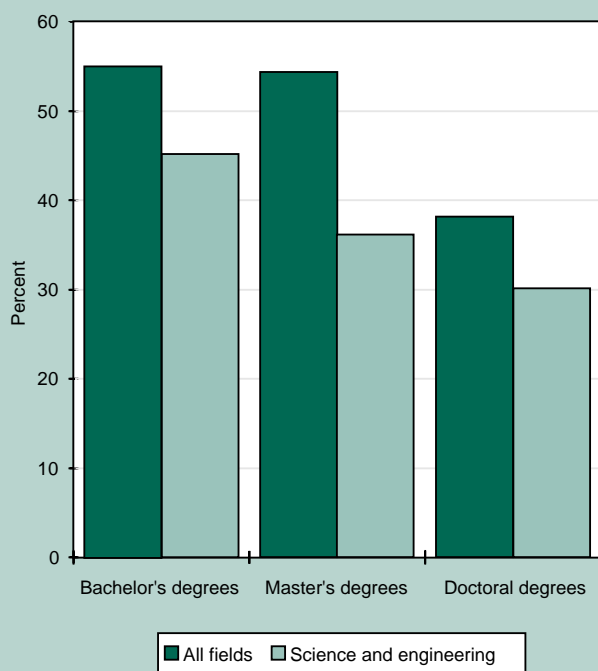


See appendix tables 1-2 and 1-6.

Women

Women constitute 51 percent of the U.S. population,³ and 46 percent of the U.S. labor force (see appendix tables 1-2 and 1-4), but only 22 percent of scientists and engineers in the labor force. (See text table 1-1.) Women, particularly white women, are approaching parity among science and engineering bachelor's degree recipients. In 1993, 45 percent of bachelor's degree recipients in science and engineering were women, up from 39 percent in 1983. (See appendix table 3-25.) Women, though, are less likely to choose science and engineering than they are to choose other fields. Women were 58 percent of bachelor's degree recipients in non-science-and-engineering fields in 1993, compared with 45 percent of bachelor's degree recipients in science and engineering. (See figure 1-2.) Within science and engineering, women are still concentrated in a few fields—predominantly the social sciences. Women earned more than half of the bachelor's degrees in psychology and social sciences, but only about one-third of the bachelor's degrees in mathematics and physical sciences, and 16 percent of bachelor's degrees in engineering.

Figure 1-2.
Percentage of degrees in science and engineering
and in all fields to women, by level of degree: 1993



See appendix tables 3-25 and 4-19.

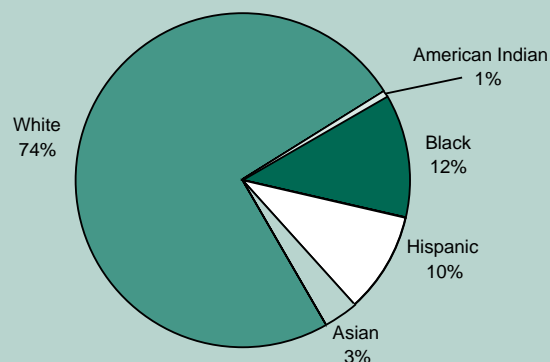
Women earn a smaller proportion of master's and doctoral degrees than they do of bachelor's degrees. Far fewer women than men are enrolled in graduate science and engineering education or earn doctoral degrees in science and engineering. Women were 36 percent of graduate enrollment in science and engineering in 1993 and were 30 percent of science and engineering doctorate recipients. (See appendix tables 4-8 and 4-24.)

Because of their more recent entry into science and engineering as well as a greater tendency than men to be out of the labor force and to be employed outside of science and engineering, women are only 22 percent of the science and engineering labor force. Also because of their more recent entry into science and engineering, far fewer women than men attain the rank of full professor in academia or attain management positions in industry.

Minorities⁴

Blacks, Hispanics, and American Indians have historically been underrepresented in science and engineering. Asians, on the other hand, are overrepresented in science and engineering. Asians were 3 percent of the U.S. population, but 5 percent of U.S. citizen doctorate recipients in 1993. Underrepresented minorities as a whole were about 23 percent of the U.S. population. Blacks constituted about 12 percent of the U.S. population, Hispanics about 10 percent, and American Indians about 1 percent. (See figure 1-3.) Although they are as likely to choose science and engineering fields as other

Figure 1-3.
Percentage of the U.S. population, by race/ethnicity:
July 1993



See appendix table 1-2.

³ As of July 1993. Source: U.S. Bureau of the Census, PPL-8, *U.S. Population Estimates, by Age, Sex, Race, and Hispanic Origin, 1990 to 1993*. Includes persons residing in the 50 States and the District of Columbia.

⁴ In accordance with Office of Management and Budget guidelines, the racial/ethnic groups described in this report will be identified as white, non-Hispanic; black, non-Hispanic; Hispanic; Asian or Pacific Islander; and American Indian or Alaskan Native. In text and figure references, these groups will be referred to as white, black, Hispanic, Asian, and American Indian. In instances where data collection permits, subgroups of the Hispanic population will be identified by subgroup name.

Text table 1-1.

Selected characteristics by sex, race/ethnicity, and disability status: 1993

Dash indicates not available.

Sex and race ethnicity	Resident population of U.S. ^a	High school graduates ^b	BA/BS degrees in all fields ^c	BA/BS degrees in S&E ^c	New BA/BS entrants to S&E employment ^d	S&E graduate school enrollment ^c	PhD degrees in S&E ^c	S&E labor force ^e
All races.....	100%	100%	100%	100%	100%	100%	100%	100%
Men.....	48.8	48.3	45.1	54.7	56.7	64.0	69.9	77.6
Women	51.2	51.7	54.9	45.3	43.3	36.0	30.1	22.4
White, not Hispanic.....	74.4	81.9	83.0	81.2	81.5	82.1	83.8	84.6
Men.....	36.3	39.7	38.1	46.5	47.5	—	53.2	66.2
Women	38.1	42.2	44.9	34.6	34.0	—	30.6	18.4
Black, not Hispanic.....	11.9	13.3	6.8	6.7	7.5	5.5	2.9	3.5
Men.....	5.6	6.1	2.5	2.9	2.8	—	1.6	2.3
Women	6.3	7.2	4.3	3.8	4.7	—	1.3	1.2
Hispanic.....	9.8	8.5	5.1	5.0	3.8	4.3	3.3	2.8
Men.....	5.0	4.0	2.1	2.5	2.2	—	1.9	2.1
Women	4.8	4.5	3.0	2.5	1.6	—	1.4	0.7
American Indian....	0.7	—	0.5	0.5	0.4	0.4	0.3	0.2
Men.....	0.3	—	0.2	0.3	0.2	—	0.2	0.2
Women	0.4	—	0.3	0.2	0.2	—	0.1	0.1
Asian.....	3.2	—	4.5	6.6	6.8	7.8	9.8	8.9
Men.....	1.6	—	2.2	3.9	4.0	—	6.6	6.9
Women	1.6	—	2.3	2.7	2.8	—	3.2	2.1
Persons with disabilities ^f	20.0	—	—	—	11.1	—	1.3	5.8
Persons without disabilities	80.0	—	—	—	88.9	—	98.7	94.2

^a Source: U.S. Bureau of the Census, Population Division, Release PPL-8, *U.S. Population Estimates, by Age, Sex, Race, and Hispanic Origin, 1990 to 1993*.

^b Source: Bruno and Adams, U.S. Bureau of the Census, Current Population Reports P20-479, October 1994. Includes persons 18–24 only. Hispanics are included in both the white and black population groups. See appendix table 1-3.

^c Figures by race/ethnicity are for U.S. citizens and permanent residents only. Sources: National Science Foundation, *Science and Engineering Degrees: 1966–93, Selected Data on Graduate Students and Postdoctorates in Science and Engineering, Fall 1993*, and *Selected Data on Science and Engineering Doctorate Awards, 1993*.

^d Source: National Science Foundation, National Survey of Recent College Graduates, 1993. Excludes full-time graduate students.

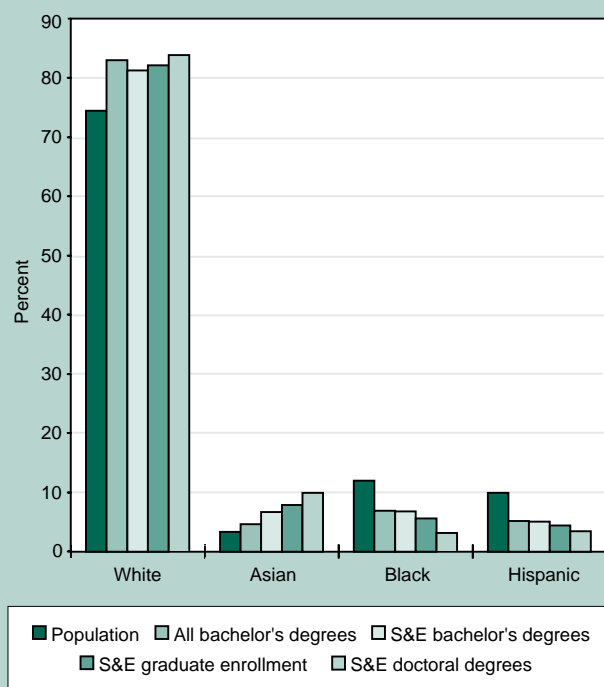
^e Source: National Science Foundation, National Survey of College Graduates, 1993. See appendix table 1-5.

^f Source: U.S. Department of Commerce, Bureau of the Census. 1993. *Americans With Disabilities: 1991–92: Data From the Survey of Income and Program Participation*, P70-33.

fields, blacks, Hispanics, and American Indians are less likely than whites to earn bachelor's degrees. (See figure 1-4.) As a group, they are only 12 percent of bachelor's degree recipients in science and engineering, as they are of bachelor's degree recipients in all fields. Steady progress has been made in these groups' share of science and engineering degrees. In 1985, blacks were 5.2 percent of bachelor's degree recipients in science and engineering, Hispanics were 3.7 percent, and American Indians were 0.4 percent. By 1993, the fraction of science and engineering bachelor's degrees earned by blacks increased to 6.7 percent, by Hispanics to 5.0 percent, and by American Indians to 0.5 percent.⁵ (See figure 1-5.) Blacks, Hispanics, and American Indians are more likely to earn degrees in the social sciences than in the natural sciences or engineering. More than half of the bachelor's degrees earned by members of these groups were in social sciences. (See appendix table 3-28 and figure 1-6.)

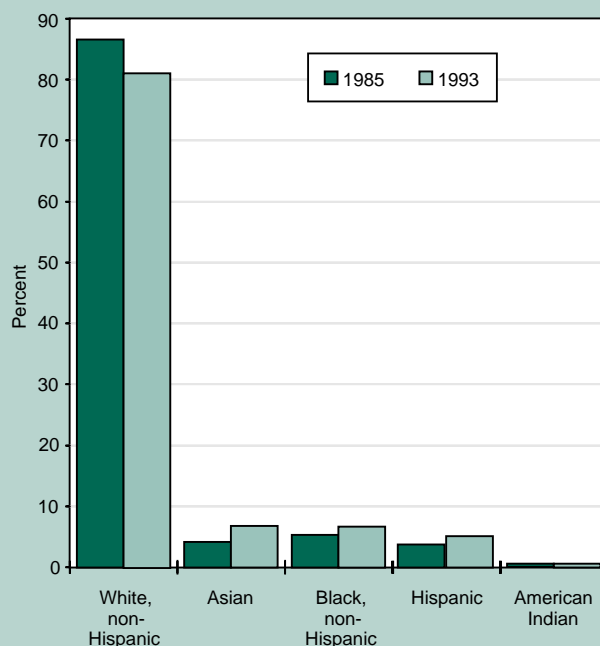
Blacks, Hispanics, and American Indians, who constitute 6 percent of the total science and engineering labor force, are disproportionately likely to earn degrees in the social sciences and to be employed as social science practitioners, for example, as social workers or clinical psychologists, rather than in social sciences per se.

Figure 1-4.
U.S. population, undergraduate and graduate education, by race/ethnicity: 1993



See text table 1-1.

Figure 1-5.
Percentage of bachelor's degrees in science and engineering to U.S. citizens and permanent residents, by race/ethnicity: 1985 and 1993



See appendix table 3-27.

Persons With Disabilities

Persons with disabilities are also underrepresented in science and engineering. About 20 percent of the population have some form of disability; about 10 percent have a severe disability.⁶ Data on participation of persons with disabilities are less available than data on other groups (for example, no data on bachelor's degrees in science and engineering by disability status are available). The data that do exist, though, point to a small proportion of persons with disabilities in science and engineering education and employment. In 1993, persons with disabilities were only 6 percent of undergraduate enrollment, 4 percent of graduate enrollment, 1.3 percent of science and engineering doctorate recipients, and 6 percent of scientists and engineers in the labor force.⁷ (See figure 1-7.)

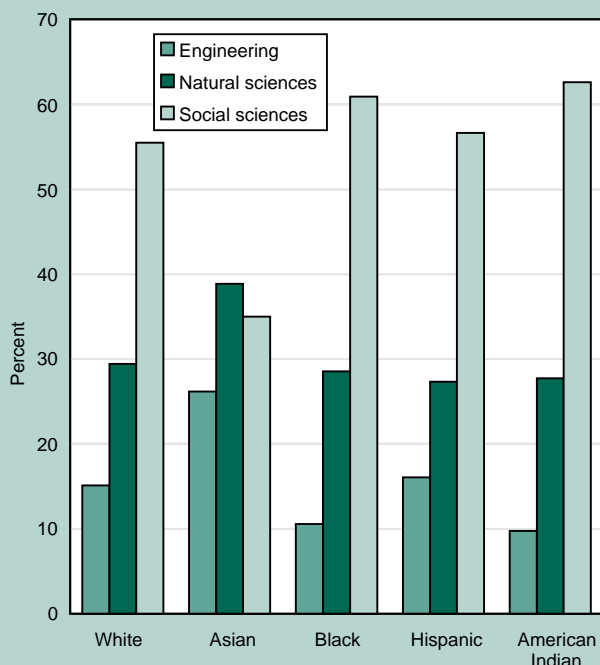
Factors influencing participation by women, minorities, and persons with disabilities in science and engi-

⁶ Estimates of the proportion of the population with disabilities vary because of differing definitions of "disability." See appendix A Technical Notes for a discussion of the limitations of estimates of the size of this group. The source of these estimates is the U.S. Department of Commerce, Bureau of the Census. 1993. *Americans With Disabilities: 1991-92: Data From the Survey of Income and Program Participation*, P70-33.

⁷ The incidence of disability increases with age. More than half of doctoral scientists and engineers who indicate they have a disability became disabled at age 35 or older. See appendix table 5-43.

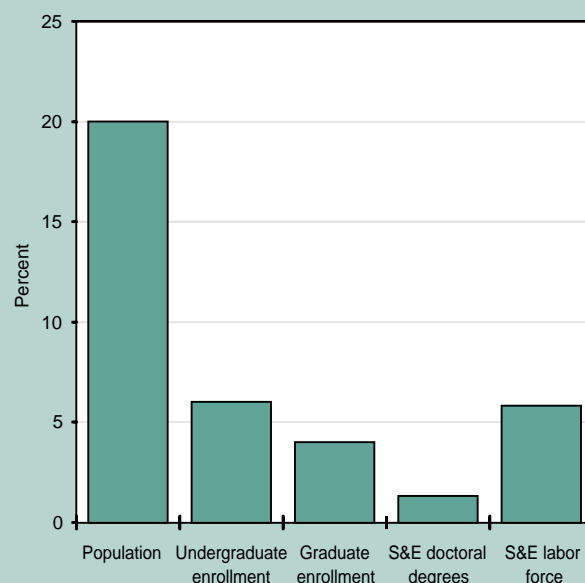
⁵ U.S. citizens and permanent residents only.

Figure 1-6.
Percentage of bachelor's degrees in science and engineering, by broad field and race/ethnicity: 1993 (U.S. citizens and permanent residents only)



See appendix table 3-27.

Figure 1-7.
Percentage of persons with disabilities in the U.S. population in undergraduate and graduate enrollment, among science and engineering doctoral degree recipients, and in the science and engineering labor force: 1993



See text table 1-1.

neering are varied and complex. They include, among others, differences in access to educational resources, differences in economic status, differences in interest (choice), cultural barriers, and lack of encouragement.⁸

Scope of This Report

The National Science Foundation (NSF) is mandated by Congress to provide biennial reports on the status of women and minorities in science and engineering. The primary purpose of this report is to monitor trends in participation at various levels. This report documents the progress that has been made by women, minorities, and persons with disabilities in science and engineering education and employment and highlights the areas in which further progress can be made. This report is the eighth in a series of reports on this subject. Like its predecessors, it examines the participation of women, minorities, and persons with disabilities in science and engineering education and in scientific and engineering occupations, including employment, salaries, and promotional opportunities.

Statistical data are presented on representation in science and engineering education at the precollege,

undergraduate, and graduate levels, and on representation in science and engineering employment.

Current data and historical trends from a number of NSF surveys are reported, and also, where appropriate, findings from externally conducted research are cited. A chronological sequence of education then workforce participation is followed. This report documents the progress that has been made in recent years and examines some of the factors that continue to hinder further participation.

Organization of This Report

Chapter 2 focuses on precollege mathematics and science education, including science and mathematics achievement, course taking, attitudes toward science and engineering, and school differences in curricula, resources, activities, and teacher qualifications.

Chapter 3 examines undergraduate education as preparation both for careers and for graduate education. This chapter presents data on trends in enrollments and degrees in 2- and 4-year colleges and universities, characteristics of first-year students, and financial support. It also discusses attrition and characteristics of undergraduate environments that are conducive to retention of women, minorities, and students with disabilities.

Chapter 4 addresses graduate enrollment, degrees, and financial support. It presents data on trends in

⁸ See, for example, Oakes, Jeannie. 1990. *Lost Talent: The Underparticipation of Women, Minorities, and Disabled Persons in Science*. Santa Monica, CA: The RAND Corporation.

enrollments and degrees, primary source of support in graduate school, time to completion of PhD, and postdoctoral fellowships.

Chapter 5 examines employment patterns including unemployment, underemployment, full- and part-time employment, and employment by field and sector. It also examines career patterns and attrition out of science and engineering, and focuses separately on academic and nonacademic employment.

Data Sources

Data for this report come from a number of sources. The primary sources of information are surveys conducted by NSF's Division of Science Resources Studies. Other sources include surveys conducted by the Department of Education's National Center for Education Statistics (NCES), by the Educational Testing Service, and by the Higher Education Research Institute.

Data on bachelor's and master's degrees come from the Integrated Postsecondary Education Data Systems (IPEDS) Completions Survey, which is part of an integrated system of surveys conducted by the National Center for Education Statistics. This survey provides data on the number and types of degrees awarded by U.S. postsecondary institutions and data on the characteristics of degree recipients.

Data on graduate enrollments come primarily from NSF's Graduate Students and Postdoctorates in Science and Engineering (GSESP) Survey. This survey provides data on the number and characteristics of graduate science and engineering students enrolled in U.S. institutions, differences in enrollment patterns, and differences in financial support patterns.

Data on doctoral degrees come primarily from the Survey of Earned Doctorates (SED), which is conducted by the National Research Council for the National Science Foundation, the National Institutes of Health, the National Endowment for the Humanities, the U.S. Department of Education, and the U.S. Department of Agriculture. This survey annually provides data on the number and characteristics of individuals receiving research doctorate degrees from U.S. institutions.

Data on employment come primarily from three surveys that will form an integrated system of NSF surveys called the Scientist and Engineer Statistics Data System (SESTAT), which produces national estimates of the entire science and engineering workforce.⁹ The Survey of Doctorate Recipients provides demographic and employment information on individuals with doctoral degrees in science and engineering. This survey is a lon-

gitudinal survey of a sample of individuals under the age of 76 who received a research doctorate in science or engineering from a U.S. institution and who were living in the United States. The National Survey of Recent College Graduates provides employment and demographic data on individuals who recently obtained a bachelor's or master's degree in a science or engineering field. The National Survey of College Graduates provides data on the number and characteristics of individuals with training and/or employment in science and engineering in the United States.

Other large-scale sources of data used in this report include the NCES National Postsecondary Student Aid Study (NPSAS), the NCES Faculty Survey, and the NCES High School and Beyond Survey.

The Technical Notes in appendix A present information on the underlying concepts, data collection techniques, reporting procedures, and statistical reliability of the primary data sources used in this report.

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- SRI International. 1991. *Youth With Disabilities: How Are They Doing? The First Comprehensive Report from the National Longitudinal Study of Special Educational Students*. Washington, DC: SRI International.

⁹ Scholars and policy analysts may access the SESTAT system through a variety of means, including access through the World Wide Web and restricted use data files. Individuals interested in obtaining more information about accessing the system should contact the Division of Science Resources Studies' Science and Engineering Personnel Program (PER) at (703) 306-1776.

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